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ABSTRACT

Trends in enrollments and degrees for physics and astronomy departments are presented. The data represent nearly 100 percent of the 306 degree-granting departments. Information is presented on the following: number of institutions by highest physics degree offered, 1976-81; number of physics degrees awarded during 1969-80; undergraduate and graduate physics enrollments; introductory physics enrollments in degree-granting institutions by geographic region, 1976-81; actual and projected number of undergraduate physics majors, 1980-81; enrollment of freshmen, sophomores, juniors, seniors, and fifth-year students who will likely obtain physics degrees; enrollment of entering foreign graduate physics students 1970-81; unfilled assistantships for first-year graduate physics students in Ph.D. departments, 1980; number of full-time and part-time graduate students; number of physics degrees granted by sex and minority group status, 1979-80; trends in astronomy enrollments and degrees, 1975-81; and astronomy enrollments and degrees by institution type. Among the findings are the following: trends of physics degrees granted clearly indicate the leveling in recent years, with bachelor's degrees falling just below 4,500, master's degrees at 1,400, and doctorates around 1,000; between fall 1979 and fall 1980, there was a 6 percent increase in enrollment in introductory physics; over 100,000 students are enrolled in introductory astronomy courses; and the number of degree-granting astronomy departments is decreasing. (SW)

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ENROLLMENTS AND DEGREES

AIP Pub. No. R-151.18 by Susanne D. Ellis February 1981

With the start of a new decade, comes a renewed interest in the "hard" sciences which is reflected in increasing physics enrollments. Last year we commented on the rising number of foreign students who enter American universities to study science; this year's data confirm the continuation of that trend. Astronomy enrollments and degrees comprise the last portion of this report.

Table I presents the changing number of institutions for the past five years and classifies them by highest physics degree offered. In 1980 seven of the four-year physics departments expanded their curricula to include a physics master's program. These additional graduate programs account in part for the recent increase in master's-granting institutions.

TABLE I. Institutions by highest physics degree offered, 1976-81:

Academic year	Doctorate granting	Master's granting	Bachelor's granting
1976-77	173	114	515
1977-78	172	110	506
1978-79	170*	104	502
1979-80	169*	96	501
1980-81	168*	103	492

** Five of these institutions have two physics doctorate-granting departments; the second one is generally an applied physics department. They are Stanford U., U. of CA-Davis, U. of CA-San Diego, Harvard U. and Cornell U.*

As the longest uninterrupted annual AIP survey, the Survey of Enrollments and Degrees has the distinction of summarizing the data of nearly 100% of the 806 degree-granting physics and astronomy departments. The trends of physics degrees granted, presented in **Figure I**, clearly indicate the leveling in recent years, with bachelor's degrees falling just below 4500, master's degrees at 1400 and doctorates around 1000. The 1979-80 figure for new physics doctorates granted was termed "unusual" by physics department chairmen who expect 1980-81 to compensate for some of those low totals they reported. A discussion of this fluctuation is presented in connection with **Figure III**.

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Fig. 1. Physics degrees awarded by academic year, 1969-80.

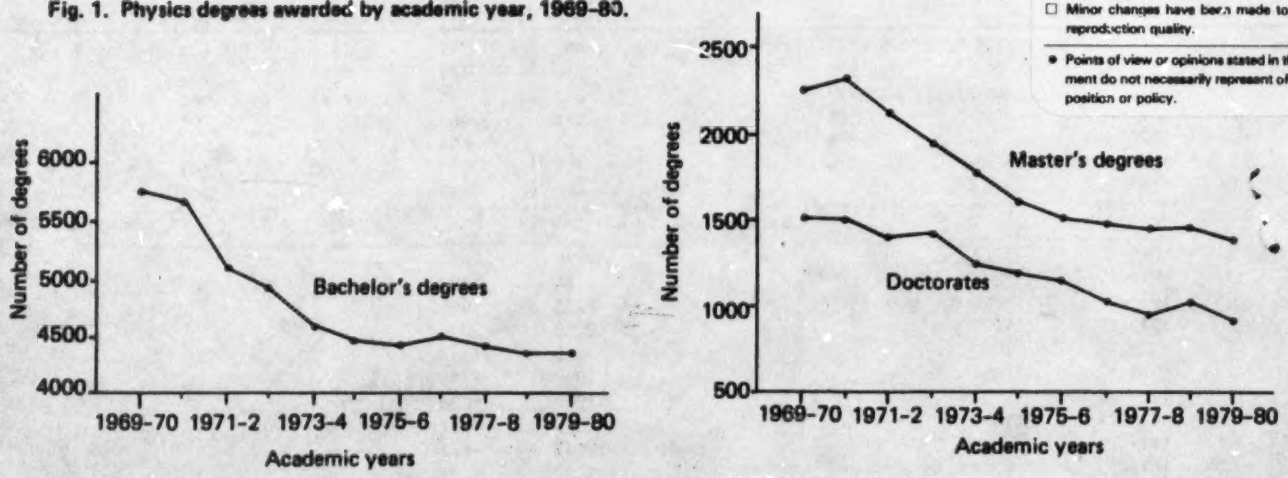

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Table II. Physics enrollments and degrees awarded by academic year 1969–81

Academic year	Number of physics degrees granted (July 1 to June 30)			Undergraduate physics-major enrollment		Graduate physics-student enrollment	
	Bachelor's	Master's	Doctorate	Juniors	Seniors	Total	1st year*
1969–70	5782	2268	1545	7480	6700	14 372	3918
1970–71	5755	2300	1530	6884	6663	14 327	3494
1971–72	5282	2143	1438	6593	6162	13 276	3336
1972–73	4923	1961	1445	6012	5806	11 804	2904
1973–74	4652	1772	1236	5858	5108†	11 119	2680
1974–75	4571	1650	1167	5660	4909†	10 410	2668
1975–76	4487	1570	1111	5888	4922†	10 372	2646
1976–77	4517	1469	1051	5711	4930†	9 991	2624
1977–78	4457	1422	971	5820	4975††	9 835	2499
1978–79	4416	1428	1033	5835	4964	9 813	2458
1979–80	4440	1370	912	5696	4942	9 647	2439
1980–81				5905	5091	9 934	2564

* *Includes part-time students who might be at the 1st-year level for more than one year.*

† *This total has been adjusted by 500 for students who are seniors for more than one year.*

†† *This total has been adjusted by 300 students who are seniors for more than one year.*

Table III. Undergraduate and graduate enrollments and degrees by institution type, 1969–81

Academic year	Number of physics degrees granted (July 1 to June 30)			Undergraduate physics-major enrollment		Graduate physics-student enrollment	
	Bachelor's	Master's	Doctorate	Juniors	Seniors	Total	1st year
			Doctorate granting institutions				
1969–70	3036	1804	1545	3869	3369	12 779	3202
1970–71	2868	1817	1530	3510	3490	12 400	2658
1971–72	2502	1640	1438	3082	2987	11 434	2449
1972–73	2265	1484	1445	2787	2717	10 227	2177
1973–74	2155	1387	1236	2644	2484	9 759	2169
1974–75	2191	1318	1167	2780	2420	9 295	2205
1975–76	2182	1249	1111	2983	2505	9 241	2163
1976–77	2184	1186	1051	2862	2502	8 867	2182
1977–78	2218	1164	971	2851	2590	8 852	2138
1978–79	2158	1183	1033	2937	2579	8 864	2107
1979–80	2142	1151	912	2696	2491	8 744	2072
1980–81				2765	2568	9 062	2223
			Master's granting institutions				
1969–70	1022	464		1281	1274	1593	716
1970–71	1044	483		1220	1175	1927	836
1971–72	982	503		1238	1210	1842	887
1972–73	820	477		1145	1088	1577	727
1973–74	810	385		939	893	1360	511
1974–75	699	332		881	741	1115	463
1975–76	604	321		916	811	1131	483
1976–77	658	283		840	761	1078	442
1977–78	590	258		832	752	983	361
1978–79	541	245		795	694	949	351
1979–80	585	219		705	650	903	367
1980–81				868	655	872	341
			Bachelor's granting institutions				
1969–70	1724			2330	2057		
1970–71	1843			2154	1998		
1971–72	1798			2273	1965		
1972–73	1838			2080	2003		
1973–74	1687			2075	1731		
1974–75	1681			1999	1748		
1975–76	1701			1989	1606		
1976–77	1675			2009	1667		
1977–78	1649			2137	1633		
1978–79	1717			2103	1691		
1979–80	1713			2295	1801		
1980–81				2272	1868		

Table IV. Introductory physics enrollments in physics-degree-granting institutions by geographic region 1976–81

Geographic region †	1976-77	1977-78	1978-79	1979-80	1980-81
New England	21 139	19 672	19 356	18 797	21 766
Mid Atlantic	44 919	44 839	42 652	41 555	43 216
E.N. Central	50 123	51 598	50 434	50 843	54 663
W.N. Central	22 018	22 253	21 115	21 805	23 406
S. Atlantic	36 272	38 519	33 097	33 966	33 800
E.S. Central	14 900	15 003	14 835	14 829	15 068
W.S. Central	32 956	29 968	26 768	28 563	30 030
Mountain	18 786	20 490	19 342	20 753	21 035
Pacific	34 628	32 635	32 084	31 318	36 150
Total	277 741	274 977	259 683	262 429	279 134

†New England—*Conn., Me., Mass., N. Hamp., R.I., Vt.;* Middle Atlantic—*N.J., N.Y., Pa.;* East North Central—*Ill, Ind., Mich., Ohio, Wisc.,* West North Central—*Iowa, Kansas, Minn., Mo., Nebr., N. Dak., S. Dak.;* South Atlantic—*Del., D.C., Fla., Ga., Md., N.C., S.C., Va., W. Va.;* East South Central—*Ala., Ky., Miss., Tenn.;* West South Central—*Ark., La., Okla., Tex.,* Mountain—*Ariz., Colo., Idaho., Mont., Nev., N. Mex., Utah., Wyo.;* Pacific—*Ala., Cal., Hawaii, Oreg., Wash.*

The numerical data for **Figure I** are presented as part of **Table II** which also includes undergraduate and graduate physics enrollments. Since the junior year is the earliest level at which students are obliged to declare their majors, the 3½% increase, though small, may signal an important change in trend.

By expanding **Table II** to distinguish the three types of physics departments one generates **Table III**. This table attributes the enrollment increases at the graduate level to the doctorate-granting institutions. The 7% increase in first-year graduate students at those institutions may represent a turning point rather than a fluctuation. **Tables VII** and **VIII** offer further details on graduate enrollments. Having presented a comprehensive summary of physics enrollments in the first three tables of this report, **Tables IV** through **XI** focus on a detailed analysis of the physics pipeline.

Introductory physics enrollments

When compared with other disciplines such as chemistry, engineering or the social sciences, physics attracts a relatively small number of majors. Introductory physics, on the other hand, is frequently a required course for engineering or health-related majors and thus enrolls over a quarter of a million freshman-sophomore level students. The 6% increase between September 1979 and September 1980 reflects the renewed interest in the hard sciences referred to at the beginning of this report.

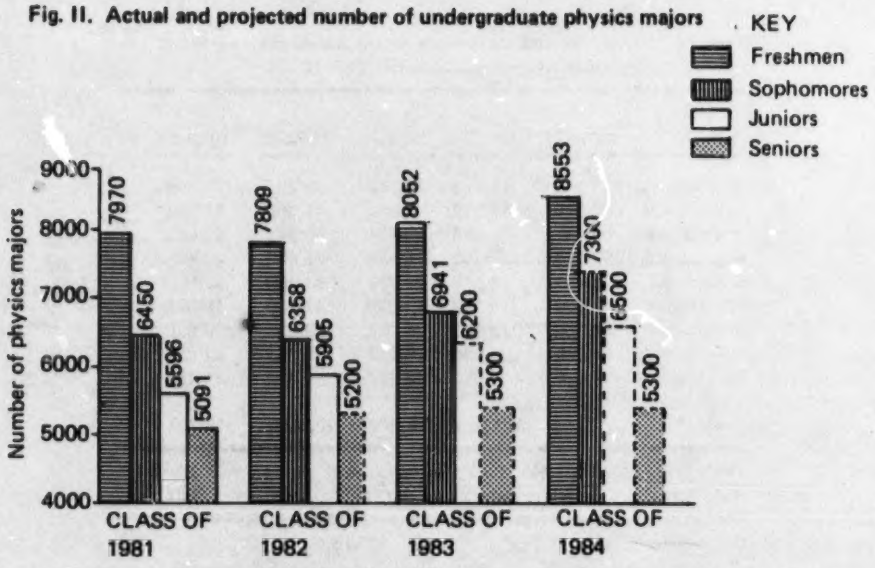
Table IV presents a five-year enrollment trend for each of nine geographic regions and shows that all regions, with the exception of the South Atlantic region, reported net increases in introductory enrollment. Analyzing these introductory enrollments with respect to the design of the course, we find that an increasing number of prospective engineering majors and a decreasing number of prospective biology or health-related majors enroll in these courses. **Table V** offers details on the 1980–81 enrollments where the engineering total of 102,000 represents a two-year increase of 15,000 students while the 75,000 health-related majors represent a three-year decline of 15,000 students. The proportional distribution of introductory enrollments among the three types of institutions remained unchanged.

Table V. Introductory physics enrollments, 1980–81.

Enrollment in introductory physics courses designed for:		Institution type* I N	I %	II N	II %	III N	III %	Total N	Total %
engineering majors		18462	27.4	13988	33.1	69493	41.0	101 943	36.5
physical science majors		13678	20.3	7269	17.2	28136	16.6	49 083	17.6
biology, health-related majors		19675	29.2	12213	28.9	43052	25.4	74 940	26.9
others		15564	23.1	8790	20.8	28814	17.0	53 168	19.0
Total introductory enrollment	N	67379		42260		169495		279134	
	%	24.2		15.1		60.7			100.0

**"Institution type" indicates the highest degree offered; type I = bachelor's degree, type II = master's degree, type III = doctorate.*

Fig. II. Actual and projected number of undergraduate physics majors



Note: Each cluster of four bars shown in **Figure II** *depict the freshmen, sophomores, juniors and seniors of four successive graduating classes. The most recent estimate of freshman physics majors is that for 1980-81 and added up to 8553. Based on the attrition of earlier classes, 5300 of them are expected to become seniors in 1983-84 and are presented above as the "class of 1984".*

Undergraduate physics majors

With an increasing number of chairmen providing estimates of their prospective physics majors, it is possible to compute the attrition rates that occur in four years of undergraduate study. Thus the first set of bars in **Figure II** follows the 1977-78 freshman physics majors through four years of undergraduate study to become the graduating class of 1981 physics bachelors. The chairmen's most recent estimates of freshmen show a significant increase over previous years and so do the number of juniors reported by them. Using these data as a new base we felt justified to revise the projections of physics majors upward by 200–300 seniors each year.

A more detailed analysis of undergraduate physics majors in different parts of the U.S. is presented in **Table VI**. The last column of this table "Fifth-year undergraduates" primarily consists of students who need an additional summer session or term to complete their degree requirements; in some cases transfers from junior colleges cause such a delay. Thus there are approximately 500 seniors each year who had been included among the seniors reported during the previous year.

Table VI. Undergraduate physics majors by geographic region and type of institution, 1980-81.

Geographic region*	Estimated** no. of freshmen	Estimated** no. of sophomores	Number of juniors	Number of seniors	Fifth-year undergraduates
New England	610	567	555	524	54
Mid. Atlantic	1 553	1 240	965	843	69
E. N. Central	1 309	1 103	893	725	87
W. N. Central	695	603	473	439	11
S. Atlantic	1 146	968	855	670	42
E. S. Central	341	270	284	210	14
W. S. Central	953	710	554	471	43
Mountain	620	459	355	372	45
Pacific	1 326	1 021	971	837	197
Total	8 553	6 941	5 905	5 091	562
Doctorate-granting inst.	3 735	3 045	2 765	2 568	283
Master's-granting inst.	1 328	995	868	655	139
Bachelor's-	3 490	2 901	2 272	1 868	140

* *See Table IV for explanation of geographic region.*
** *Estimates of potential physics majors made by the physics department chairmen.*

Graduate enrollment

When examining graduate physics students three characteristics are noteworthy: (1) almost 90% of the physics students compared with 75% of those in related disciplines are assured of financial support*, (2) a rising number of first-year students hold foreign citizenship, and (3) a large proportion of the graduate students study on a full-time basis. The second characteristics is illustrated by the trend shown in **Table VII**, while **Table VIII** offers details on the third characteristic of study status.

For the second time the question of unfilled assistantships for first-year graduate students was asked on this annual survey, and in 1980 as in 1979 approximately 200 assistantships remained unfilled for the fall term. **Table IX** addresses itself to those abundant sources of support for entering graduate physics students. Their distribution among the different geographic regions though, is by no means uniform. The percentage of additional students for whom there would have been support available, ranged from 3% in the East North Central region to over 20% in both South Central regions.

Based on findings from the Survey of Physics Bachelor's Degree Recipients. AIP Pub. No. R-211.12

Table VII. Trend in entering foreign graduate physics students, 1970–81.

Academic year	Foreign Students N	%	Total first-year students
1970–71	615	17.6	3494
1971–72	606	18.2	3336
1972–73	612	21.0	2904
1973–74	614	22.9	2680
1974–75	594	22.3	2668
1975–76	551	20.8	2646
1976–77	637	24.2	2624
1977–78	648	26.0	2499
1978–79	618	25.2	2458
1979–80	739	30.3	2439
1980–81	844	32.9	2564

Table VIII. Full-time and part-time graduate physics enrollment by type of institution, 1973–81.

Academic year	Total number of graduate students: Institution type* II Full-time	Part-time	Sub-total	III Full-time	Part-time	Sub-total	Total
1973–74	734	626	1360	8810	949	9759	11119
1974–75	623	492	1115	8326	969	9295	10410
1975–76	628	503	1131	8439	802	9241	10372
1976–77	576	507	1083	8119	789	8908	9991
1977–78	546	437	983	8174	678	8852	9835
1978–79	468	481	949	8185	679	8864	9813
1979–80	550	353	903	8059	685	8744	9647
1980–81	484	388	872	8302	760	9062	9934

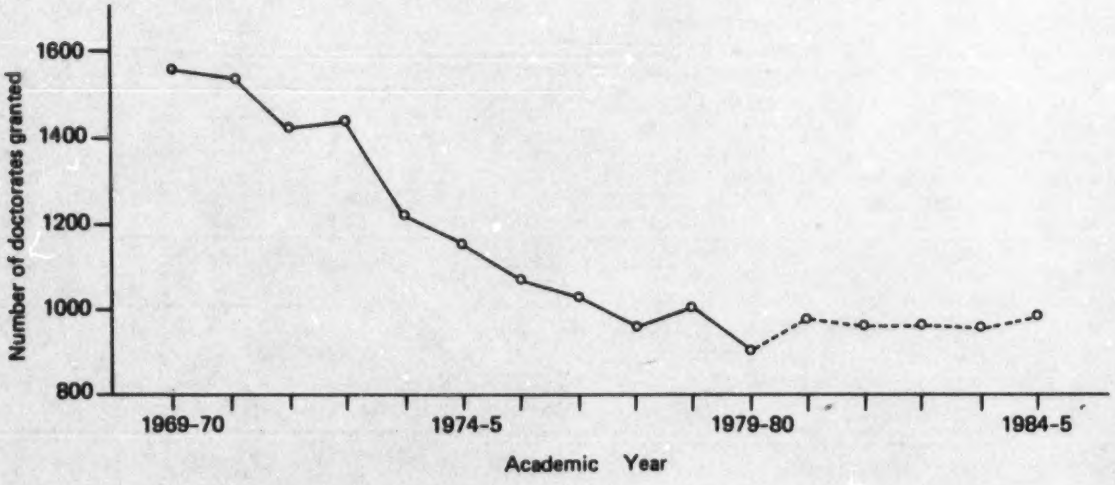
** Institution type indicates the highest physics degree offered: type II = master's degree, type III = doctorate.*

Table IX. Unfilled assistantships for first-year graduate physics students in PhD departments, September 1980.

Geographic region*	Departments with 0 unfilled assistantships	1-2	3-5	>6	Approximate no. of unfilled assistantships	No. of 1st yr. grad. students
New England	11	8	0	0	12	295
Mid. Atlantic	17	5	7	0	35	396
E. N. Central	9	5	0	1	17	391
W. N. Central	8	1	1	1	14	110
S. Atlantic	12	3	4	1	30	236
E. S. Central	2	4	3	0	18	68
W. S. Central	6	4	2	4	46	171
Mountain	7	2	3	1	22	137
Pacific	13	1	1	2	22	419
Total no. of	85	33	21	10	216	2223

**See Table IV for explanation of geographic region.*
Note: 24 departments did not answer the question of unfilled assistantships.

Figure III. Actual and projected number of physics doctorates granted, 1969–1984



The median number of years of graduate study to complete a physics doctorate is five, with a range from three to more than ten years. In connection with **Table II** reference was made to the unexpectedly low number of doctorates conferred in 1979–80. The numbers of first-year graduate students at PhD-granting universities have been used to project the number of doctorates granted five years later because we found these numbers correlate well. However the total for 1979–80 of 912 doctorates is surprisingly low constituting only 42% of the entering students of September 1975; a more common range has been 44% to 47%. But physics department chairmen point out that doctorates are conferred throughout the year and at times the June 30 cut-off date transfers a large number of summer degree recipients into the next academic year; this was evidently the case in the summer of 1980. Thus **Figure III** continues to project the annual number of physics doctorates granted at approximately 1000.

Degrees granted

Table X offers details of where physics degrees are granted and by what types of institutions. Unlike the trend tables at the beginning of this report, **Table X** distinguishes between degree recipients who enter the job market with a master's degree and those who are granted master's degrees enroute to higher degrees. While one would expect the latter group to be enrolled at PhD-granting institutions, there exists a small number of masters (47 in the class of 1980) who transfer from master's institutions to larger universities and continue their studies toward a PhD. It may be of interest to note that terminal master's degrees declined more rapidly than master's degrees awarded enroute to higher degrees in the 1970's, (a decline of 50% for the former compared with 29% for the latter, since 1971).

Table X. Physics degrees by type of institution and geographic region, 1979–80.

	Bachelor's degrees			Master's degrees		Terminal master's degrees		Doctorates
Geographic region*	Institution type** I	II	III	Institution type** II	III	institution type** II	III	Institution type** III
New England	144	16	377	0	122	5	68	145
Mid. Atlantic	349	50	414	2	160	13	68	187
E. N. Central	286	173	267	24	118	46	81	122
W. N. Central	210	69	104	2	25	27	15	50
S. Atlantic	256	52	257	3	55	19	40	99
E. S. Central	64	38	50	6	12	4	17	17
W. S. Central	142	68	120	2	33	23	25	45
Mountain	72	4	186	0	37	6	36	46
Pacific	190	115	367	8	155	29	84	201
Subtotal	1 713	585	2 142	47	717	172	434	912
				764		606		
Total		4 440			1370			912

* *See Table IV for explanation of geographic region.*

** *Institution type indicates the highest physics degree offered; type I = bachelor's degree, type II = master's degree, type III = doctorate.*

Table XI. Number of physics degrees granted by sex and minority group status, 1979-80.

Type of degree	Sex	Total no. of degrees	Minority groups: Black	Am. Ind.	Puerto Rican	Mex. Am.	Other Latin	Oriental	Asian Indian	Arab	Total minorities
Bachelor's	Men	4010	67	5	12	12	9	74	11	19	209
	Women	430	11	0	2	1	1	8	2	2	27
	Total	4440	78	5	14	13	10	82	13	21	236
Master's enroute	Men	697	12	0	0	1	2	38	3	8	64
	Women	67	5	0	0	0	0	1	1	1	8
	Total	764	17	0	0	1	2	39	4	9	72
Terminal master's	Men	557	11	1	1	1	3	18	1	6	42
	Women	49	1	0	0	0	2	3	1	2	9
	Total	606	12	1	1	1	5	21	2	8	51
Doctorate	Men	853	8	1	2	2	9	45	31	8	106
	Women	59	0	0	0	0	1	3	1	0	5
	Total	912	8	1	2	2	10	48	32	8	111

Other sources: "1979-80 Survey of Physics and Astronomy Bachelor's Degree Recipients", AIP Pub. No. R-211.12
"1979-80 Graduate Student Survey", AIP Pub. No. R-207.13

A frequent request for information deals with the proportion of women and minorities among physics degree recipients. While department chairmen contribute some of these data, a large proportion of **Table XI** is based on reports from the individual graduates. The table identifies eight minority groups, the members of which received physics degrees in 1979-80.

The minority groups are listed in a way that presents those with a high proportion of U.S. citizens in columns toward the left side of **Table XI** and those with a high proportion of foreign citizens on the right. The Oriental group is more mixed and includes approximately 30% to 40% U.S. citizens.

ASTRONOMY

When one examines choices students make to fulfill science requirements, introductory astronomy stands out as a popular choice. Thus we find more than one-hundred-thousand students enrolled in those courses and the numbers are still increasing. On the other hand, the number of degree-granting astronomy departments is decreasing; a net change from 70 departments to 67 departments occurred between 1979-1980 and 1980-81. A closer examination of these changes reveals an increase in PhD-granting astronomy departments by three while four bachelor's – and two master's-granting departments suspended their astronomy degree programs.

Seven years ago the Survey of Enrollments and Degrees began to collect and analyze astronomy data from separate astronomy departments as well as those combined with physics departments. Correcting for inconsistencies of reporting during the early stages of a survey, we are able to present astronomy enrollment and degree data in **Table XII** starting with the academic year 1975-76. A complete listing of each department with its data is available upon request.

Table XII. Trend in astronomy enrollments and degrees, 1975-1981.

Academic year	No. of astronomy degrees granted (July 1 – June 30): Bachelor's	Master's enroute	Terminal master's	Doctor's	Undergraduate astronomy major enrollment: Juniors	Seniors	Graduate astronomy enrollment: Total	1st year
1975-76	172	56	35	93	305	280	780	165
1976-77	184	58	35	96	290	270	790	170
1977-78	177	64	31	93	295	270	803	171
1978-79	165	73	42	90	270	249	710	145
1979-80	165	54	27	106	262	242	698	154
1980-81					275	238	686	164

Table XIII. Astronomy* enrollments 1980–81 and degrees 1979–80 by type of institution**

		Type I	Type II	Type III	Total
Astronomy departments	Combined	11	4	14	29
	Separate	6	2	30	38
	Total	17	6	44	67
Astronomy degrees	Bachelor's	35	12	118	165
	Master's enroute	-	3	51	54
	Terminal master's	-	6	21	27
	Doctor's	-	-	106	106
Astronomy enrollments	Introd. courses for science majors	559	123	2 431	3 113
	Introd. courses for nonscie. majors	3 015	1 351	36 158	40 524
	Introd. astronomy courses offered in physics departments	-	-	-	61 939
	Total introductory enrollments				105 576
	Junior astronomy majors	55	27	193	275
	Senior astronomy majors	48	32	158	238
	First-year graduate students	-	4	160	164
	Total graduate enrollment	-	25	661	686

** This survey includes only degree-granting astronomy departments.*

***"Institution type" indicates the highest astronomy degree offered; type I = bachelor's degree, type II = master's degree, type III = doctorate.*

Table XIII offers details on the most recent enrollment and degree totals by comparing the contributions made by the doctorate-granting astronomy departments with those of the other two groups.